with some truth, that the majority of teachers aim at impressing a set of facts upon their pupils rather than training them how to attack and discuss mathematical problems. Unfortunately, there are few teachers who are free agents; the requirements of the various examining boards must first be satisfied before personal individuality can be freely exercised, and much of the best work of the first-rate teacher is of a character that examinations can scarcely test. At the same time, mathematical teachers should undoubtedly know something of the science of teaching, and cannot fail to profit by a knowledge of the experience of others. In the present volume, there is much of real interest and value. After preliminary general discussions, the author examines in great detail the theory of geometrical teaching and somewhat briefly the elements of a suitable course in algebra and trigonometry. Such a work as this should find a place in the common-room libraries of our secondary schools.

(4) This is a continuation of the author's former treatise on algebra for secondary schools. It opens with the binomial theorem and includes all that usually finds a place in an advanced school course. Among the chief features of the book may be noted an excellent chapter on complex quantity; the geometry of vectors is developed, and the use of trigonometric functions renders the account reasonably complete. By introducing the notation of the calculus, the treatment of limits is simplified and the usual applications in the theory of equations become possible. The work on continued fractions is put rather more briefly than usual, but nothing of importance for any ordinary purpose has been omitted. The volume has an attractive appearance, the examples are really good, and the essay questions at the end will be of great assistance to scholarship candidates.

(5) The study of non-Euclidean geometry has, till recently, attracted the attention only of the specialist; no doubt this has been due principally to the general belief that the difficulties were so considerable, the philosophical problems so intricate, and the subject so contrary to ordinary experience that the ordinary mathematician would, without prolonged study, make little of it. Time, however, invariably lowers the levels and extends the boundaries of the territory accessible to ordinary students. There are now a number of elementary text-books which make its pursuit a comparatively easy task. There are two valuable studies by Mr. Frankland—"The Theories of Parallelism" and "Euclid I., with a Commentary"—there is a primer by Prof. Manning, a more elaborate treatise by Prof. Coolidge, and, for those who read German, the works of Killing, Liebmann, Hilbert, Vahlen, etc.

The translation of Prof. Bonola's valuable critical and historical summary will be of the greatest assistance to students. The book opens with an account of the attempts to prove Euclid's parallel postulate which were made from the time of the Greek geometers down to the seventeenth century. The next section deals with the period when men were first beginning to inquire whether a form of geometry could exist independently of this postulate. This work is associated with the names of Saccheri, Lambert, Wolfang Bolyai and others; but it was not until the time of Gauss, Taurinus, Lobatschewsky, and Johann Bolyai that the foundations of non-Euclidean geometry were securely laid. A most interesting sketch is given of the growth of thought in this period. The concluding chapter discusses the later work of Riemann, Helmholtz, Lie, Cayley, Klein, etc. There are five appendices; these deal with (*a*) the fundamental principles of statics; (*b*) Clifford's parallels; (*c*) constructions; (*d*) the independence of projective geometry; (*e*) a method of exhibiting the impossibility of proving Euclid's postulate by a consideration of the analogous geometry of a system of circles orthogonal to a fixed circle. This last appendix, which is due to Prof. Carslaw and is based on Wellstein's work, establishes, by an elementary and elegant method, a number of interesting theorems in hyperbolic geometry.

(6) These notes on the calculus, drawn up for science and engineering students, are intended to supplement the earlier parts of the ordinary text-books. The first chapter gives the analytical geometry of the straight line, the second illustrates the meaning of differentiation by examples from physics and geometry; in the next three the rules for differentiations are given; and the last two, after a few pages on the geometry of the conic, give an account of integration and its applications.

OUR BOOKSHELF.

Kausale und konditionale Weltanschauung. By Max Verworn. Pp. 46. (Jena: Gustav Fischer, 1912.) Price 1 mark.

EVEN when one profoundly disagrees, it is always a pleasure to listen to Prof. Max Verworn, for he has clear-cut convictions which he states vividly and with enthusiasm. The present essay is an exposition of "conditionism" as contrasted with "causalism," and it deals hard blows at vitalism, dualism, entelechy, free will, and other naive and uncritical assumptions, as Verworn thinks.

It may be of interest to state the five propositions of conditionism:—(1) There are no isolated

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or absolute things. All things, *i.e.* all processes and states, are conditioned by other processes or states. (2) There is no process or state which is dependent on a single factor. All processes or states are conditioned by numerous factors. (3) Every process or state is inevitably determined by the sum of its conditions. Only under similar conditions do similar processes or states occur, and, conversely, different processes and states presuppose different conditions. (4) Every process or state is identical with the sum of its conditions. The totality of the conditions is the process or state. (5) All the conditions of a process or state are of equal value for its occurrence in so far as they are necessary. But it does not seem difficult to accept all these propositions and yet remain a good vitalist.

Dizionario di Merceologia e di Chimica Applicata. By Prof. V. Villavecchia. Terza editione. Vol. ii. Lettere N–Z e Indice. Pp. 1360. (Milan: Ulrico Hoepli, 1913.) Price 15 lire.

THE scope of this work and its especial features were explained when the first volume was reviewed. The second volume embraces articles from N to Z, and occupies 1170 half pages. All the articles are written very concisely; in fact, so concisely that, *e.g.*, the author has not yielded to the temptation to do more than mention the Italian occurrences of petroleum in the article "Petrolio greggio."

The remainder of the work, covering 200 pages, forms a very complete index. It is carried through in four languages, and includes also botanical and zoological names. Thus this index very greatly assists the reader who is not sufficiently conversant with the Italian language to depend on the alphabetical arrangement of the subject-matter in the body of the two volumes.

The Vertebrate Skeleton. By Prof. Sidney H. Reynolds. Pp. xvi + 535. Second edition. (Cambridge: University Press, 1913.) Price 15*s*. net

THIS work, belonging to the Cambridge Zoological series, was reviewed at length in the issue of NATURE for July 15, 1897 (vol. lvi., p. 245), at the time of its original publication. The present edition has been revised and brought up to date. Prof. S. W. Williston has assisted Prof. Reynolds in this work, having rewritten the chapter on the Sauropsida and that on the general account of the skeleton in reptiles, as well as contributing some notes on birds and on the Stegocephalia.

Heaton's Annual: the Commercial Handbook of Canada and Boards of Trade Register, 1913. Edited by E. Heaton and J. B. Robinson. Pp. 401. (Toronto: Heaton's Agency; London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd.) Price 5*s*.

THE ninth issue of this yearly handbook dealing with the resources of Canada is full of interest. It will prove directly useful to teachers of commercial geography, and much of the general information it provides will appeal to scientific readers.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

On the Appearance of Helium and Neon in Vacuum Tubes.

SINCE reading before the Chemical Society (see NATURE, February 13, p. 653) the paper on the presence of helium and neon in vacuum tubes (containing hydrogen) after the gas had been sparked, we have carefully compared the spectrum lines that are supposed to be characteristic of these gases. The result has been interesting. In the case of neon and hydrogen there appears to be a large number of lines in the secondary spectrum of hydrogen that are very close to the important lines of neon. If only those lines are taken that differ by less than a quarter of an Ångstrom unit (using the measurements of Watson), there are fifty-seven instances. It is not necessary to give all of them, but if the neon lines of intensity 4 and greater be taken it is found that there are twenty instances:—

Intensity	Neon	Hydrogen	Intensity	Neon	Hydrogen
9	6506·69	6506·82	4	5872·27	5872·12
10	6402·43	6402·51	10	5852·62	5852·72
9	6383·14	6383·20	4	5760·74	5760·58
5	6175·09	6175·14	7	5343·40	5343·43
7	6143·31	6143·30	4	5122·40	5122·64
6	6096·36	6096·21	6	5080·52	5080·73
6	6074·51	6074·66	4	4537·93	4537·91
5	6030·20	6030·30	4	3682·37	3682·20
5	5975·76	5975·68	9	3520·61	3520·60
5	5882·06	5882·17	6	3472·68	3472·65

Moreover, according to Watson there are only two neon lines of intensity 10, and only four of intensity 9. Of these six principal neon lines, five are paralleled in the secondary hydrogen spectrum, and the sixth line of neon (of intensity 9), 6334·65, is near to a hydrogen one, 6335·53.

There are also fifty-three neon lines that differ from those of the secondary hydrogen spectrum by less than one Angström unit and by more than a quarter. This makes 110 lines that are paralleled in the two spectra.

In the case of neon and helium there are also a series of lines that run parallel. Three of these lines were pointed out by Watson (Proc. Roy. Soc., vol. lxxxi., p. 185). He says: "The lines at 6678 and 3447, however, were very bright on the same plate, and it must be concluded that there are two neon lines almost coincident with the helium lines." "There appears to be a similar pair at 4713, though I was unable to obtain a plate on which the neon line alone was present. The wave-lengths of the lines concerned are:—

He	6678·37	...	4713·25	...	3447·73
Ne	6678·50	...	4713·51	...	3447·83

And no reason can be at present assigned to their close proximity."

In the case of neon and oxygen, one of the two bright neon lines of intensity 8 and wave-length 5330·90 is very near to a bright oxygen line wave-length 5330·84.

J. NORMAN COLLIE.
HUBERT S. PATTERSON.

February 22.

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